Outcome of revascularization procedures for peripheral arterial occlusive disease in Ontario between 1991 and 1998: A population-based study

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Purpose: **We describe the outcome of revascularization procedures used to treat peripheral arterial occlusive disease (PAOD), using population-based administrative data.**

Methods: **A retrospective population-based cohort study utilizing administrative databases in Ontario, Canada, was conducted for fiscal years 1991 to 1998 to identify patients who underwent arterial bypass surgery and percutanous transluminal angioplasty to treat PAOD. The Kaplan-Meier method was used to calculate cumulative survival rate and amputation-free survival rate. To analyze factors that affect these rates, multivariate analysis was performed with Cox proportional hazard models.**

Results: **Over the study period 15,824 patients underwent bypass operations and 11,548 underwent angioplasty. For patients who underwent bypass surgery, 5-year cumulative survival rate was 61.5% and major amputation–free survival rate was 83.4%, compared with 69% and 92.2%, respectively, for patients who underwent angioplasty. Male sex, older age, diabetes, and heart disease were associated with increased risk for death after revascularization procedures. Increased risk for major amputation after revascularization procedures was associated with male sex, older age, and diabetes, whereas hypertension was linked to decreased risk.**

Conclusion: **To evaluate the long-term outcome of revascularization procedures for PAOD at the population level, survival and major amputation–free survival rates should be used, because they provide more clinically accepted estimates compared with the correlation between utilization rates for revascularization and amputation procedures, which have been used to describe outcome in previously published reports in the literature. (J Vasc Surg 2003;38:279-88.)**

Evaluation of the therapeutic effectiveness of interventional procedures used to treat peripheral arterial occlusive disease (PAOD) requires use of several outcome measures that assess factors that affect patients directly (eg, survival, amputation-free survival, quality of life, and pain relief), and clinical measures (eg, laboratory test measurements).[1]

Inasmuch as limb salvage is considered the primary goal of management of PAOD, especially in patients with critical limb ischemia,[2,3] tentative conclusions might be drawn by examining the outcome of surgery for PAOD as measured by the rate of lower extremity amputation.[4]

To identify the population-based therapeutic effectiveness of surgery to treat PAOD, the association between revascularization procedures and amputation rate has been examined in several studies.[5-10] The assumption in these studies is that if revascularization procedures avert the need for amputation in some patients, then a negative correlation should exist between rates of amputation and revascularization procedures.[10]

Several population-based studies have reported decreased rate of amputation in association with increased use of revascularization procedures.[8-10] On the other hand, some studies showed no change in lower extremity amputation rate.[5-7]

The limitations of these studies make drawing conclusions as to the effectiveness of surgery in preventing amputation extremely difficult. These limitations include the following:

1. Estimates of procedure rates were made at the population level rather than the patient level, and they therefore might reflect the incidence of multiple procedures in the same patient.

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2. Rates of primary and secondary amputation were not examined separately. Arterial bypass surgery (ABS) may avert, delay, or precipitate secondary amputation, but it has no role in primary amputation. Therefore, if the overall reduction in amputation rate is the result of reduction in primary amputation rather than secondary amputation, attribution of increased use of bypass surgery as a cause of this reduction is not true. Furthermore, if there is reduction in amputation rate overall but the rate of secondary amputation is increasing, this will give a further false impression of the effect of bypass surgery.
3. The incidence of underlying PAOD is not known.

Determination of amputation rate in surviving patients after revascularization procedures (amputation-free survival rate) may overcome some of these limitations, to assess how well bypass procedures avert or delay amputation. Furthermore, long-term survival rate after surgery is an important outcome that can be used to evaluate revascularization procedures on a population-based level.

Therefore, to describe the outcome of revascularization procedures for PAOD using population-based administrative data, survival and amputation-free survival rates after ABS and angioplasty were determined in this retrospective population-based study from Ontario, Canada.

METHODS

Study design

A retrospective population-based cohort study utilizing administrative databases in Ontario was conducted for fiscal years 1991 to 1998 (April 1 of the calender year to March 31 of the following year).

Data sources

The study was conducted at the Institute for Clinical Evaluative Science in Ontario. Case records for bypass surgery were obtained from the Canadian Institute for Health Information (CIHI) hospitals discharge abstract database. This database records discharges from all acute care hospitals in Ontario, including day surgeries. The CIHI database contains information on patient demographics, diagnosis, and procedures. The diagnosis codes are based on the *International Classification of Disease,* 9th revision (ICD-9),[11] and treatment codes are based on the Canadian Classification of Diagnostic, Therapeutic and Surgical Procedures (CCP).[12] Because not all percutaneous transluminal angioplasty (PTA) procedures are in-patient procedures, the CIHI database cannot provide full information about them. Therefore the Ontario Health Insurance Plan (OHIP) database was used to determine PTA procedures. This database records claims paid for health care providers by the Ontario Ministry of Health, which is the sole source of health care reimbursement in the province of Ontario. The diagnosis and procedure codes are based on Ontario Ministry of Health fee-for-service and diagnosis codes.[13] The OHIP database lacks demographic information on patients. Therefore it was linked to the Ontario Registered Persons Data Base (RPDB), which records demographic information that describes persons who are or were entitled to medical services under OHIP. Each patient in these databases (CIHI, OHIP, RPDB) has the same unique encrypted identifier.

Identification of cases

ABS procedures. Using the CIHI database, we obtained discharge abstracts for all patients 45 years or older who were discharged between April 1, 1991, and March 31, 1999, with a procedure code for lower extremity ABS (CCP codes 51.25, 51.29). Records with CCP code 51.25 were considered as aorto-ilio-femoral bypass procedures, and records with CCP code 51.29 were considered as other peripheral bypass procedures, which implies infrainguinal reconstruction. To ensure that only procedures for PAOD were included, records with a primary diagnosis code indicating abdominal aortic aneurysm (ICD-9 codes 441.3-441.7), iliac artery aneurysm (ICD-9 codes 442.0, 442.2), or lower extremity artery aneurysm (ICD-9 code 442.3) were excluded. Duplicate records, which are defined as a record with similar unique encrypted identifier, admission date, procedure, and diagnosis codes, were excluded. Records with missing unique encrypted identifier also were excluded. To identify characteristics of patients undergoing these procedures, the data were sorted by unique encrypted identifier to transform them to the patient level. Co-morbid conditions, ie, diabetes mellitus (ICD-9 code 250), hypertension (ICD-9 code 401-405), and coronary artery disease (ICD-9 codes 410-414), were identified from the records for each patient.

PTA procedures. The OHIP claim records at the Institute for Clinical Evaluative Science for fiscal year 1991 are not complete; therefore the decision was made to include only records for fiscal years 1992 through 1998.

Claims for all patients made between April 1, 1992, and March 31, 1999, with a service code for lower extremity PTA (J025) were obtained from the OHIP database. Service code J025 is not specific for lower extremity angioplasty; it was also used for renal angioplasty until 1994 and is still in use for upper extremity and carotid PTA.

Although not all physicians record the diagnosis on OHIP claims, records with diagnosis codes indicating renal vascular anomalies (code 593.8), hypertensive renal disease (code 403), renal failure (codes 584, 584), transient ischemic attack (code 435), or chronic arteriosclerotic cerebrovascular disease (code 437) were excluded in an effort to decrease the number of renal and carotid angioplasty cases. To obtain the demographic features of patients who underwent PTA, the claim records were linked to the RPDB by the unique encrypted identifier. Any record for patients younger than 45 years was excluded. Duplicate records, defined as a record with similar unique encrypted identifier, service date, procedure, and diagnosis codes, were excluded. Records with missing unique encrypted identifier also were excluded. The data were then sorted by the unique encrypted identifier to transform them to the patient level.

Outcome of revascularization procedures. The follow-up period was defined as time from the admission date for ABS and the service date for PTA until readmission for major amputation, death, or March 31, 1999.

After identifying patients who underwent ABS or PTA as described, these patients were followed up in the CIHI database from the date of surgery (admission date for ABS, either aorto-ilio-femoral or other peripheral bypass procedure) or from the PTA service date until the date of major amputation (admission date for amputation) with the unique encrypted identifier. Major amputation was defined as through-ankle (CCP code 96.13), below-knee (CCP code 96.14), or above-knee (CCP code 96.15). In addition, these patients were followed up from the date of the procedure until the date of death by linking patient records to the RPDB with the unique encrypted identifier.

Data validation

To validate coding for PAOD surgical procedures, 300 discharge abstract records from the CIHI database with ABS codes and a hospital code indicating Sunnybrook and Women's College Health Science Centre, a major teaching hospital in Toronto, were randomly selected over the study period. These records were compared with the corresponding patient charts from this hospital to assess level of agreement for procedure and comorbid condition coding.

The percentage of CIHI records matched with patient charts was calculated for both ABS and amputation records. With patient charts as the standard, we calculated sensitivity, specificity, positive and negative predictive values, and overall accuracy, to describe validity and accuracy for comorbid condition recording in the matched CIHI records. Sensitivity is the proportion of patient charts with the comorbid diagnoses that have a positive CIHI recording for the diagnoses, whereas specificity is the proportion of charts without the comorbid diagnoses that have a negative CIHI recording for the diagnoses. Accuracy and validity refer to how closely a CIHI record of having or not having a comorbid condition corresponds with the presence or absence of such a condition.

Statistical analysis

Survival rate after revascularization procedures. The Kaplan-Meier method (product-limit method)[14] was used to estimate cumulative survival rate after ABS and PTA. Survival was defined as time in years from the procedure date until death. If a patient had undergone more than one procedure, follow-up was started from the first procedure. Data for patients who did not die before the end of study (March 31, 1999) were considered censored data.

Patients who underwent ABS were subdivided into aorto-ilio-femoral bypass and other peripheral bypass groups. Survival rate was calculated for these groups in a similar way and were compared with the log-rank test.

Major amputation–free survival rate after revascularization procedures. The Kaplan-Meier method (product-limit method)[14] was used to estimate cumulative major amputation–free survival rate after both ABS and PTA.

Major amputation–free survival was defined as time in years from the procedure until major amputation. If a patient had undergone more than one procedure, follow-up was started from the first procedure. Also, if a patient had more than one major amputation after the procedure, the first amputation was counted as the event. Data for patients who did not experience the event before the end of the study (March 31, 1999) and data for patients who died before an amputation was performed were considered censored data. Patients who underwent ABS were subdivided into aorto-ilio-femoral bypass and other peripheral bypass groups. Major amputation–free survival rate was calculated for these groups in a similar way and were compared with the log-rank test.

A Cox proportional hazards model[15,16] was used to determine the effect of age at the time of the procedure, gender, and comorbid condition (diabetes mellitus, hypertension, coronary artery disease) on survival rate and major amputation–free survival rate after ABS, whether aorto-ilio-femoral or other peripheral bypass procedure. Because the OHIP database lacks information on comorbid conditions, the Cox proportional model was fitted only for age and sex after PTA. Age was entered into the model as a continuous variable. Other variables, eg, sex (male, female) and comorbid conditions (present or absent) were entered into the model as dichotomous variables. All variables were entered into the model simultaneously without use of stepwise or conditional procedures.

All P values reported were two-tailed and were considered significant at .05.

Statistical analyses were performed with Statistical Applications Software, version 8 (SAS Institute, Cary, NC).

RESULTS

Baseline characteristics

Patient baseline characteristics are summarized in Table I. Over the study period 15,824 patients underwent bypass operations and 11,548 patients underwent angioplasty. More than one third of patients were women. Patients who underwent PTA were younger than those who underwent other peripheral bypass surgery ($P < .0001$). On the other hand, patients who underwent aorto-ilio-femoral bypass surgery were younger than those who underwent angioplasty ($P < .0001$). Prevalence of diabetes, hypertension, and coronary artery disease in patients who underwent PTA was not recorded because the OHIP database lacks detailed information on comorbid conditions.

Data validation

Accuracy for recording bypass surgery in the CIHI database records, as compared with patient charts, was 91.3%. Although specificity for recording comorbid conditions was high, sensitivity was low. Overall accuracy for recording comorbid conditions was moderate (Table II).

Table I. Characteristics of patients who underwent lower extremity revascularization procedures secondary to peripheral occlusive disease, in Ontario, fiscal years 1991-1998

	ABS	*AIF*	*OPB*	*PTA**
Number of patients	15,824	4053	12,072	11,548
Mean age (y) (±SD)	66.3 (11.9)	61.8 (10.3)	67.7 (11.9)	65.6 (10.1)
Sex (% F/M)	37.6/62.4	42/58	36.1/63.9	40.2/59.8
Diabetes (%)	4447 (28.1)	665 (16.4)	3851 (31.9)	—
Hypertension (%)	3497 (22.1)	969 (23.9)	2607 (21.6)	—
Coronary artery disease (%)	3766 (23.8)	960 (23.7)	2885 (23.9)	—

ABS, Arterial bypass surgery; *AIF,* aorto-Iliac-femoral bypass surgery; *OPB,* other peripheral bypass surgery; *PTA,* percutanous transluminal angioplasty.
*Fiscal years 1992-1998.

Table II. Level of agreement between matched charts for patients who underwent arterial bypass surgery with corresponding CIHI discharge abstract records for comorbid conditions

Comorbid condition	*Sensitivity* (%)*	*Specificity† (%)*	*Positive predictive value‡ (%)*	*Negative predictive value§ (%)*	*Overall accuracy‖ (% agreement)*
Diabetes	56.6	82.1	70.8	71.1	71.0
Hypertension	52.1	89.1	84.4	62.0	69.3
Coronary artery disease	42.4	94.9	86.2	68.5	72.3

CIHI, Canadian Institute for Health Information; *TP,* True positive results; *TN,* true negative results; *FP,* false positive results; *FN,* false negative results.
*Sensitivity = TP × 100%/(TP + FN).
†Specificity = TN × 100%/(TN + FP).
‡Positive predictive value = TP × 100%/(TP + FP).
§Negative Predictive Value = TN × 100%/(TN + FN).
‖Overall accuracy = (TP + TN) × 100%/(TP + TN + FP + FN).

Survival after revascularization procedures

Mean follow-up for patients who underwent ABS was 3.1 ± 2.4 years. During follow-up 5074 patients died. Five-year survival rate for these patients was 61.5% ± 0.38% (Fig 1). When survival rate was compared between patients who underwent aorto-ilio-femoral bypass and those who underwent other peripheral bypass procedures, 5-year survival rate was 74.7% ± 0.8% versus 56.8% ± 0.6%, respectively ($P < .0001$, log-rank test) (Fig 1).

Increased risk for death after ABS was associated with increased age, male sex, coronary artery disease, and diabetes. On the other hand, hypertension was associated with decreased risk (Table III).

For patients who underwent PTA, mean follow-up was 3.1 ± 2 years. During follow-up 2556 patients died. Five-year survival rate was 68.9% ± 0.6% (Fig 2). Risk for death after PTA was higher in men and older patients (Table III).

Major amputation–-free survival after revascularization procedures

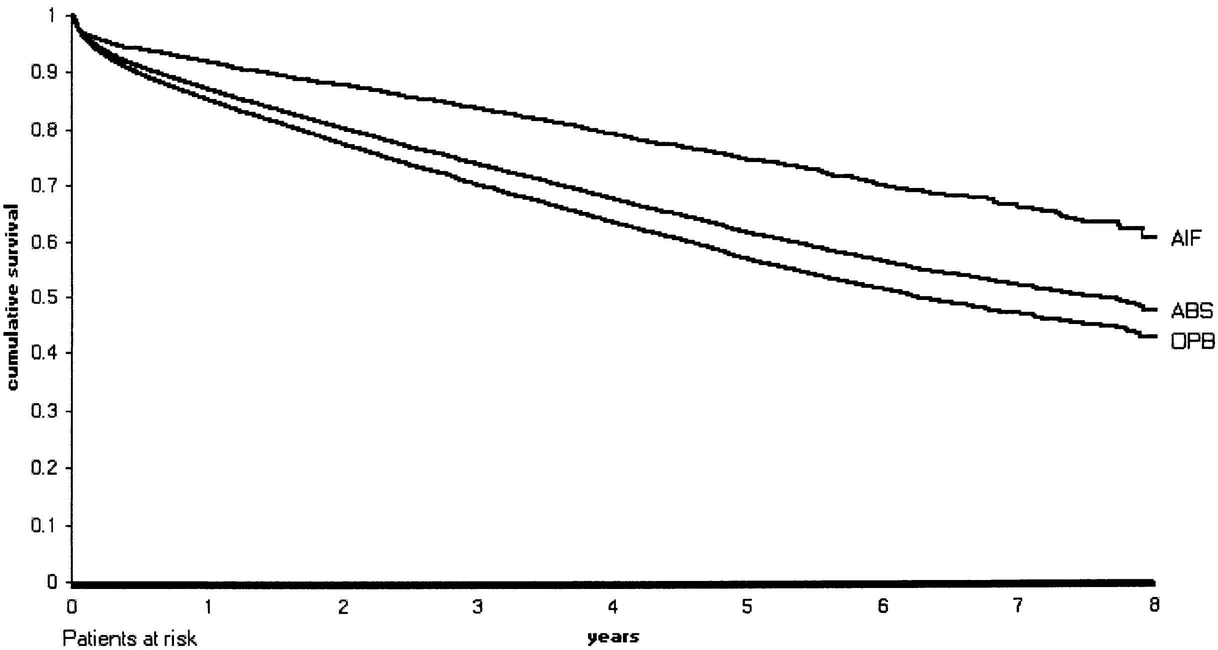
Freedom from any major amputation in surviving patients after arterial bypass surgery at 5 years was 83.4% ± 0.37% at 5 years (Fig 3). It was significantly better at 5 years in patients who underwent aorto-ilio-femoral bypass (94.0% ± 0.5%) than in those who underwent other peripheral bypass procedures (79.4% ± 0.5%; $P < .0001$) (Fig 3).

Increased risk for amputation after ABS was associated with increased age, male sex, and diabetes. On the other hand, hypertension was associated with decreased risk (Table IV).

Five-year major amputation–free survival for patients who underwent PTA was 92.2% ± 0.34% (Fig 4). Increased risk for major amputation after PTA was associated with increased age and male sex (Table IV).

DISCUSSION

This study was undertaken to determine the outcome of revascularization procedures for PAOD on a population basis. The overall 5-year survival rate for patients who underwent ABS was 61.5%, compared with 69% for those who underwent PTA. The higher survival rate in the PTA group might be attributed to a higher proportion of patients with mild to moderate athersclerotic disease as compared with the surgery group. Dormandy et al[17] showed a 70% 5-year survival rate for patients with intermittent claudication, and other studies have reported a 38% to 48% 5-year survival rate for patients with critical leg ischemia treated surgically.[18] However, because of absence of clinical indications (intermittent claudication vs critical leg ischemia) for intervention in the databases, comparison between survival rates for these procedures with previously published reports is not possible.



Patients at risk								
AIF	4,053	3,333	2,802	2,263	1,784	1,315	829	410
ABS	15,824	12,192	9,749	7,515	5,660	3,952	2,453	1,148
OPB	12,072	9,068	7,121	5,381	3,979	2,711	1,670	756

Fig 1. Kaplan-Meier survival curves after bypass surgery. *ABS,* Arterial bypass surgery; *AIF,* aorto-iliac-femoral bypass surgery; *OPB,* other peripheral bypass surgery. Note: Standard error is less than 1% for each point in the curves.

Furthermore, when ABS was subdivided to the two procedure codes, CCP code 51.25 (aorto-ilio-femoral bypass, which includes aortofemoral, aortoiliac, aortopopliteal, and iliofemoral bypass) and CCP code 51.25 (other peripheral bypass, which includes distal bypass surgery and extra-anatomic bypass), 5-year survival rate in patients who underwent aorto-ilio-femoral bypass was 75%, compared with 57% for those who underwent other peripheral bypass procedures. Again, because of lack of procedure specificity, comparison with other reported rates is difficult. However, we hypothesized that most procedures under CCP code 51.25 are aortofemoral surgeries and that most procedures under CCP code 51.29 are distal bypass procedures. Five-year survival rate after aorto-ilio-femoral bypass was in the range of the reported 5-year survival rate after aortobifemoral bypass, ranging from 68% to 80%.[19-22] Also, 5-year survival rate after other peripheral bypass procedures was in the range of the reported 5-year survival rate after infrainguinal arterial reconstruction bypass, ranging from 38% to 59%.[23-25]

Age,[26-28] male sex,[27,29] coronary artery disease,[26,28,30] diabetes,[19,22,30-33] and hypertension[30,33] have all been reported as predictors for increased mortality in patients with PAOD. In this study, multivariate models were used to account for these risk factors simultaneously in predicting death after revascularization procedures. Age, male sex, diabetes, and coronary artery disease were associated with increased risk for death after revascularization procedures. However, hypertension was associated with decreased risk, possibly because hypertension is underreported in the database.

Five-year major amputation–free survival rate for patients who underwent ABS was 83.4%, compared with 92.2% for those who underwent PTA. This might be explained by the suggestion that PTA procedures are mostly performed in patients with intermittent claudication, whereas bypass surgeries are usually performed in patients with critical ischemia.

When bypass surgery was subdivided to aorto-ilio-femoral bypass and other peripheral bypass groups, 5-year major amputation–free survival rates were 94% and 79%, respectively. These finding can be explained in that aorto-ilio-femoral bypass, which was performed to treat aortoiliac occlusive disease, is associated with better long-term results than is surgery (ie, other peripheral bypass procedures) performed to treat distal arterial disease.

The only population-based study examining amputation-free survival rate after revascularization procedures was by Hallett et al.[9] This group studied estimated major amputation–free survival in 271 patients without diabetes

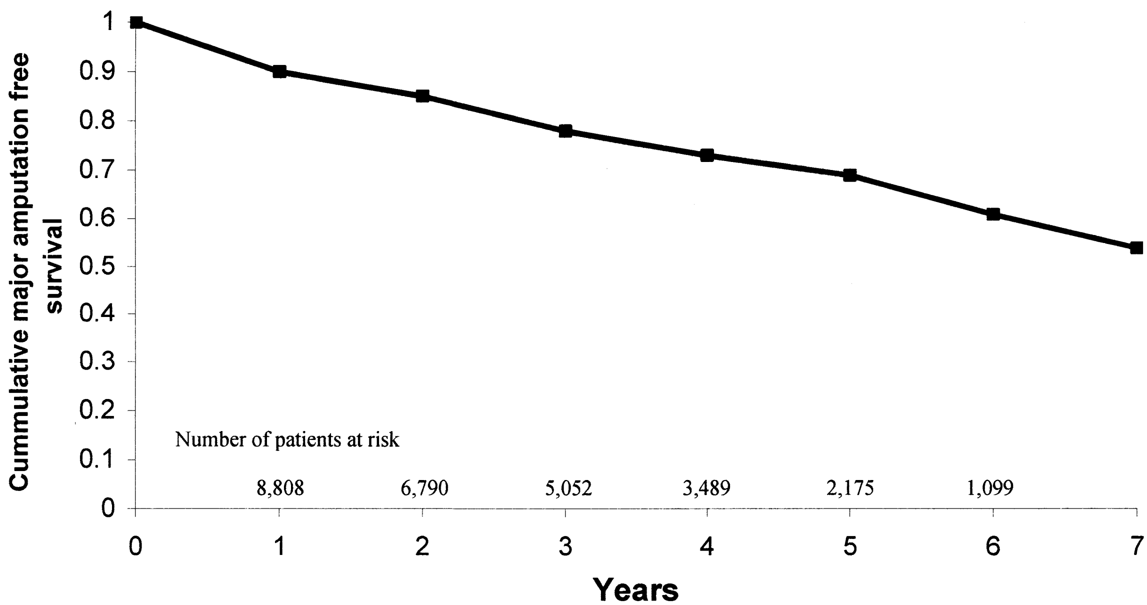


Fig 2. Kaplan-Meier survival curve after percutanous transluminal angioplasty in 11,584 patients. Note: Standard error is less than 1% for each point in the curve.

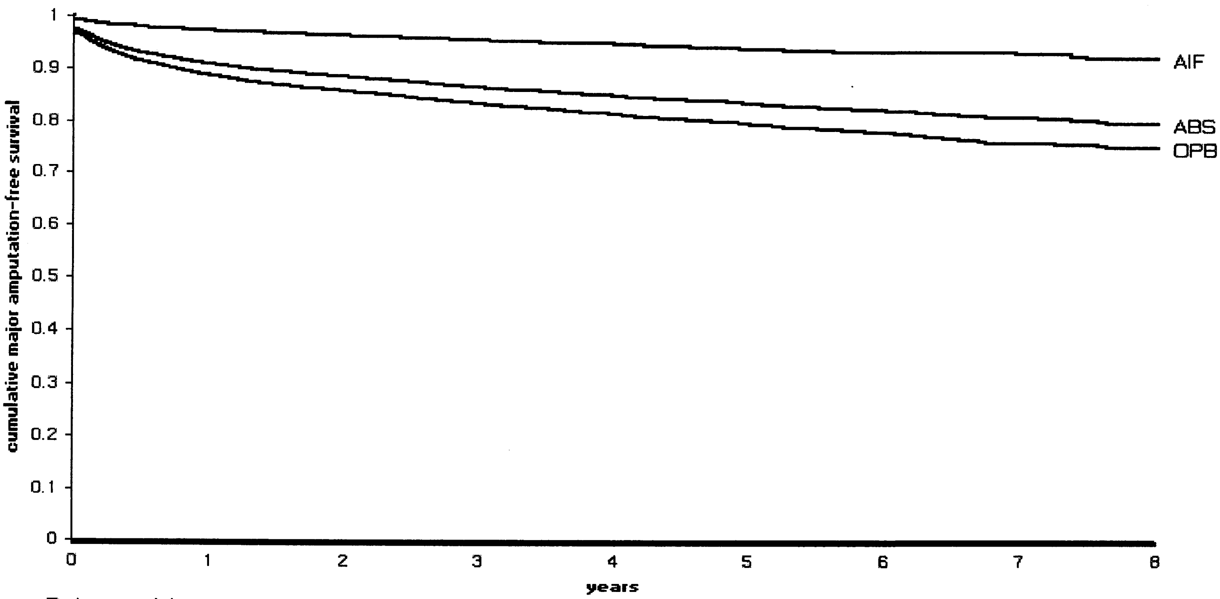
Table III. Risk factors for death after revascularization procedures to treat POAD

Risk factor	*Risk ratio*	*95% confidence interval*	P*
Arterial bypass surgery			
Age (per each year of age)	1.054	1.051-1.057	<.0001
Male sex	1.26	1.19-1.33	<.0001
Hypertension	0.91	0.85-0.97	.0038
Coronary artery disease	1.48	1.40-1.57	<.0001
Diabetes	1.68	1.59-1.78	<.0001
Aorto-iliac-femoral bypass surgery			
Age (per each year of age)	1.066	1.059-1.074	<.0001
Male sex	1.21	1.06-1.39	.0052
Hypertension	0.92	0.79-1.08	.3006
Coronary artery disease	1.52	1.32-1.74	<.0001
Diabetes	1.56	1.33-1.83	<.0001
Other peripheral bypass surgery			
Age (per each year of age)	1.048	1.045-1.051	<.0001
Male sex	1.24	1.17-1.33	<.0001
Hypertension	0.91	0.84-0.98	.011
Coronary artery disease	1.50	1.41-1.61	<.0001
Diabetes	1.63	1.53-1.73	<.0001
Percutanous transluminal angioplasty			
Age (per each year of age)	1.057	1.052-1.061	<.0001
Male sex	1.25	1.16-1.36	<.0001

POAD, Peripheral occlusive arterial disease.
*Cox proportional hazards model.

and 172 patients with diabetes who underwent revascularization procedures to treat PAOD. Estimates at 5-years were 95% and 87%, respectively, for patients without or with diabetes. This study has many limitations, including small sample size; small geographic area, which may have led to selection bias for the population studied; and failure to differentiate between patients who underwent bypass surgery, including aortoiliac and infrainguinal procedures, and those who underwent PTA.

Age,[1,17] male sex,[1,29] and diabetes[34-41] are associated with increased risk for development and local progression of PAOD. Although hypertension is associated with increased risk for PAOD,[34-38,42-44] its role in progression of the disease is not well-established.[30] Furthermore, age and



Patients at risk

AIF	4,053	3,256	2,721	2,189	1,717	1,259	789	391
ABS	15,824	11,267	8,885	6,809	5,079	3,534	2,183	1,009
OPB	12,072	8,200	6,321	4,739	3,458	2,341	1,432	636

Fig 3. Kaplan-Meier major amputation–free survival curves after bypass surgery. *ABS,* Arterial bypass surgery; *AIF,* aorto-iliac-femoral bypass surgery; *OPB,* other peripheral bypass surgery. Note: Standard error is less than 1% for each point in the curves.

diabetes are well-documented factors for increased risk for amputation in patients with PAOD.[36,45-47] The effect of these risk factors on amputation rates after revascularization procedures was examined in multivariate statistical models. In all models, age, male sex, and diabetes were associated with increased risk for amputation. In some models, coronary artery disease was associated with increased risk for amputation. On the other hand, all models showed hypertension associated with decreased risk for amputation, possibly because hypertension is underreported in the database. However, historically, plasma volume expansion has been used for patients with critical leg ischemia to increase blood pressure, thereby improving distal blood flow.[48] Maintaining adequate blood pressure is important for limb perfusion, and aggressive blood pressure treatment may decrease limb perfusion and thus worsen ischemic pain.[1] Therefore this association between hypertension and decreased risk for amputation may be true, but requires further study.

In evaluation of these results, several potential limitations related to use of administrative databases should be considered. First, service codes used in the OHIP database have not kept pace with developments in medical technology and intervention. Therefore OHIP is limited to the degree to which certain procedures can be specified. For example, service code J025, which was used to identify PTA cases, is not specific for lower extremity angioplasty, but was also used for renal angioplasty until 1994 and is still in use for upper extremity and carotid PTA. Although an effort was made to decrease the number of renal and carotid angioplasty cases by excluding the records with diagnosis codes indicating diseases other than PAOD, only 73 of 17,879 records were excluded. Most physicians do not record the diagnosis on the claims statement, because in most cases a diagnosis is not required for payment.[49] However, an expert consultant suggested that more than 85% of the cases included are indeed PAOD (Dr Stuart Bell, Department of Diagnostic Imaging, University of Toronto, 2002).

Second, procedure codes in the databases lack procedure specification. Service code J025 is used for both aortoiliac and distal PTA. Similarly, CCP codes 51.25 and 51.29 lack procedure specification; 51.25 is used to code aortofemoral, aortoiliac, aortopopliteal, and iliofemoral together, and 51.29 is used for coding both distal and extra-anatomic bypass surgery to treat PAOD. Furthermore, clinical indications for these procedures, whether performed to treat intermittent claudication or critical ischemia, are not recorded in the databases. These factors combined make comparison with other clinical studies difficult, because each procedure has its own indications and natural history.

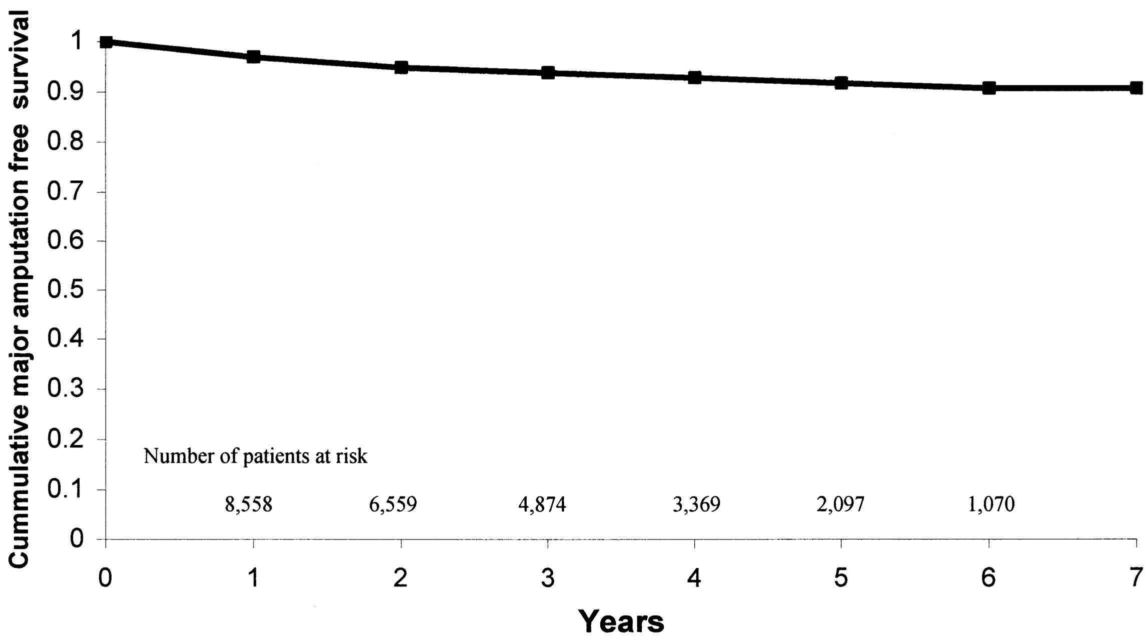


Fig 4. Kaplan-Meier major amputation–free survival curve after percutanous transluminal angioplasty in 11,584 patients. Note: Standard error is less than 1% for each point in the curves.

Table IV. Risk factors for major amputation after revascularization procedures to treat POAD

Risk factor	*Risk ratio*	*95% confidence interval*	P*
Arterial bypass surgery			
Age (per each year of age)	1.030	1.026-1.035	<0.0001
Male sex	1.22	1.12-1.34	<0.0001
Hypertension	0.84	0.75-0.93	0.0007
Coronary artery disease	1.14	1.04-1.26	0.0208
Diabetes	2.50	2.28-2.73	<0.0001
Aorto-iliac-femoral bypass surgery			
Age (per each year of age)	1.024	1.009-1.040	0.0017
Male sex	1.65	1.21-2.24	0.0014
Hypertension	0.90	0.64-1.26	0.5373
Coronary artery disease	0.99	0.72-1.39	0.9813
Diabetes	2.46	1.80-3.36	<0.0001
Other peripheral bypass surgery			
Age (per each year of age)	1.021	1.017-1.026	<0.0001
Male sex	1.14	1.03-1.25	0.0082
Hypertension	0.86	0.76-0.96	0.0071
Coronary artery disease	1.20	1.08-1.33	0.0005
Diabetes	2.23	2.03-2.44	<0.0001
Percutanous transluminal angioplasty			
Age (per each year of age)	1.035	1.027-1.044	<0.0001
Male sex	1.44	1.22-1.70	<0.0001

POAD, Peripheral occlusive arterial disease.
*Cox proportional hazards model.

Finally, the databases do not specify which limb the procedure was performed on. Thirty percent of patients with critical leg ischemia require an intervention in the contralateral leg within 5 years.[50] Therefore amputation-free survival rates may be underestimated if the revascularization procedure was performed on one limb and subsequent amputation was performed on the other limb later.

In summary, this study documents the relatively low long-term survival rates associated with revascularization procedures at the population level. Amputation-free survival rate after revascularization can be used to describe the postoperative clinical course. In addition, it provides more clinically accepted estimates of long-term outcome of revascularization procedures at the population level, which may be of great interest to patients undergoing revascularization procedures to treat PAOD. Physicians could use survival and amputation-free survival rates and factors that influence them to explain to patients the long-term outcome of revascularization procedures. Furthermore, the findings of this study provide some initial parameters for investigating the effect of revascularization procedures on amputation rate. This could be achieved by repeating a similarly designed study in Ontario over the next decade and comparing the outcomes for these two periods.

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